

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): AKAMATSU et al.	Atty. Dkt.: 01-065-DIV
Serial No.: Unknown	Group Art Unit:
Filed: Concurrently herewith	Examiner:
Title: ELECTRICAL WIRING OF SEMICONDUCTOR DEVICE AND METHOD OF MANUFACTURING SEMICONDUCTOR DEVICE	

Commissioner for Patents  
Arlington, VA 22202

Date: September 9, 2003

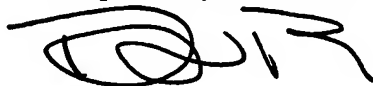
**INFORMATION DISCLOSURE STATEMENT**

Sir:

Pursuant to 37 C.F.R. §1.56, the reference(s) listed on the attached Form PTO-1449 is/are being submitted for consideration by the Examiner without any admission that it/they constitute(s) statutory prior art, or without any admission that it/they contain(s) subject matter that anticipates the invention or renders the invention obvious to a person of ordinary skill in the art.

The Examiner is requested to initial the attached PTO Form-1449 and to return a copy of same to the undersigned attorney as proof that the listed reference(s) has/have been considered and made of record.

Respectfully submitted,



David G. Posz  
Reg. No. 37,701

Posz & Bethards, PLC  
11250 Roger Bacon Drive, Suite 10  
Reston, VA 20190  
(703)707-9110 (phone)  
Customer No. 23400

FORM PTO-1449	ATTY. DKT NO.	01-065-DIV	SER. NO.
	APPLICANT	AKAMATSU et al.	
	FILING DATE	September 09, 2003	GROUP

## REFERENCE DESIGNATION

## U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUB CLASS
		6,348,735	Feb.19, 2002	Yamaoka		
		5,759,916	June 2, 1998	Hsu et al.		
		5,703,403	Dec. 30, 1997	Sobue et al.		
		6,066,891	May 23, 2000	Yamaoka et al.		
		4,989,064	January 29, 1991	Kubokoya et al.		
		5,345,108	Sept. 6, 1994	Kikkawa		
		4,141,022	Feb. 20, 1979	Sigg et al.		
		5,589,713	Dec. 31, 1996	Lee et al.		
		5,236,869	August 17, 1993	Takagi et al.		
		5,427,666	June 27, 1995	Mueller et al.		
		5,049,975	Sept. 17, 1991	Ajika et al.		
		5,459,353	October 17, 1995	Kanazawa		
		5,202,579	April 13, 1993	Fujii et al.		
		4,887,146	Dec. 12, 1989	Hinode		

## FOREIGN PATENT DOCUMENTS

## TRANSLATION

		DOCUMENT NUMBER	DATE	COUNTRY	NAME	CLASS	SUB CLASS	YES	NO
		B2-2555949	9/96	JAPAN				X	
		10-98041	4/98	JAPAN				X	
		10-106972	4/98	JAPAN				X	
		11-354519	12/99	JAPAN				X	
		6-275555	9/94	JAPAN				X	
		0430403	6/91	EPO					
		0525637	2/93	EPO					
		3-3395	1/91	JAPAN				X	
		JP6-163877	6/94	JAPAN				X	

## OTHER REFERENCES (including Author, Title, Date, Pertinent Pages, etc.)

EXAMINER		DATE CONSIDERED

FORM PTO-1449	ATTY. DKT NO.	01-065-DIV	SER. NO.
	APPLICANT	AKAMATSU et al.	
	FILING DATE	September 9, 2003	GROUP

## REFERENCE DESIGNATION

## U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUB CLASS
		6,099,701	Aug. 2000	Liu et al.		
		5,780,908	July. 1998	Sekiguchi et al.		

## FOREIGN PATENT DOCUMENTS

								TRANSLATION	
		DOCUMENT NUMBER	DATE	COUNTRY	NAME	CLASS	SUB CLASS	YES	NO
		5-74961	3/93	JAPAN				X	
		6-151815	5/94	JAPAN				X	
		4-42537	2/92	JAPAN				X	
		3-262127	11/91	JAPAN				X	
		63-152147	6/88	JAPAN				X	
		4-107954	4/92	JAPAN				X	
		5-90268	4/93	JAPAN				X	
		63 142832	6/88	JAPAN				Abstract Only	

## OTHER REFERENCES (including Author, Title, Date, Pertinent Pages, etc.)

		Tsunohara, "EM Resistance When W Through Hole Is Used," <u>Semiconductor World</u> , Dec. 1995, pages 174-179 (partial translation provided).
		Koyama, "EM Securing Method in Al Wiring Limiting Evaluation," pages 98-111 (partial translation provided).
		Wendt et al., "Process Integration for Barrier Layers and Al-Alloys Using a Sputtering Cluster Tool," <u>Proceedings of the 22<sup>nd</sup> European Solid State Device Research Conference/Microelectronic Engineering</u> , Sept. 14, 1992, pages 371-374.
		Ting, "New Structure For Contact Metallurgy," <u>IBM Technical Disclosure Bulletin</u> , Vol. 25, No. 12, May 1983, pages 6398-6399.
		Jin et al. , "Bias Effect on the Microstructure and Diffusion Barrier Capability of Sputtered TiN and TiOxNy Films," <u>Japanese Journal of Applied Physics Part 1, Regular Papers, Short Notes &amp; Review</u> , May 1992, No. 5A, pages 1446-1452
		Koubuchi et al., Effects of Si on Electromigration of Al-Cu-Si/TiN Layered Metallization," <u>J. Vac. Sci. Technol. B</u> , Vol. 10, No. 1, Jan./Feb. 1992, pages 143-148.
EXAMINER		DATE CONSIDERED

FORM PTO-1449	ATTY. DKT NO.	01-065-DIV	SER. NO.
	APPLICANT	AKAMATSU et al.	
	FILING DATE	September 9, 2003	GROUP

## REFERENCE DESIGNATION

## U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUB CLASS

## FOREIGN PATENT DOCUMENTS

## TRANSLATION

		DOCUMENT NUMBER	DATE	COUNTRY	NAME	CLASS	SUB CLASS	YES	NO

## OTHER REFERENCES (including Author, Title, Date, Pertinent Pages, etc.)

		Kikkawa, "A Quarter-Micrometer Interconnection Technology Using a TiN/Al-Si-Cu/TiN/Al-Si-Cu/TiN/Ti Multilayer Structure," <u>IEEE Transactions on Electron Devices</u> , Vol. 40, No. 2, February 1993, pages 296 - 302.
		Mandl et al., "Diffusion Barrier Properties of Ti/TiN Investigated By Transmission Electron Microscopy," <u>J. Appl. Phys.</u> , Vol. 68, No. 5, Sept. 1990, pages 2127-2132.
		Sobue et al., "Metastable Phase Formation in Al Alloy/TiN/Ti/Si Systems," <u>First International Symposium on Control of Semiconductor Interfaces</u> , Nov. 1993.
		Pramanik et al., "Barrier Metal for ULSI-Its Manufacturing Process and Reliability," <u>Solid State Technology</u> , July 1991, page 27 (partial translation provided).
		Freiberger et al., "A Novel Via Failure Mechanism in an Al-Cu/Ti Double Level Metal System," <u>IEEE/IRPS</u> , Jan. 1992, pages 356-360.
		Gardner et al., "Mechanical Stress as a Function of Temperature for Aluminum Alloy Films," <u>J. Appl. Phys.</u> , Vol. 67, No. 4, Feb. 1990, pages 1831-1844.
		Nicolet et al., "Diffusion Barriers in Layered Contact Structures," <u>J. Vac. Sci. Technol.</u> , Vol. 19, No. 3, Sept./Oct. 1981, pages 786-793.
		Iwabuchi et al., "A Highly Reliable Pure Al Metallization with Low Contact Resistance Utilizing Oxygen-Stuffed TiN Barrier Layer," <u>1986 Symposium on VLSI Technology - Digest of Technical Papers</u> , May 1986, pages 55-56.
		Sinke et al., "Oxygen in Titanium Nitride Diffusion Barriers," <u>Appl. Phys. Lett.</u> , Vol. 47, No. 5, September 1985, pages 471-473.
EXAMINER		DATE CONSIDERED